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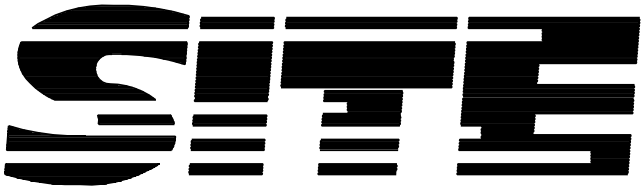

SUPERFUND INNOVATIVE
TECHNOLOGY EVALUATION

Technology Profiles
Ninth Edition

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

NOTICE

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FOREWORD

The U.S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and waste resources. Under a mandate of national environmental laws, EPA strives to formulate and implement actions leading to a compatible balance between human activities and the ability of the natural systems to support and nurture life. To meet these mandates, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory (NRMRL), is EPA's center for investigating technological and management approaches for reducing risks from threats to human health and the environment. The focus of NRMRL's research program is on methods for preventing and controlling pollution to air, land, water, and subsurface resources; protecting water quality in public water systems; remediating contaminated sites and groundwater; and preventing and controlling indoor air pollution. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

This document has been produced as part of NRMRL's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

ABSTRACT

The Superfund Innovative Technology Evaluation (SITE) Program, now in its eleventh year, is an integral part of EPA's research into alternative cleanup methods for hazardous waste sites around the nation. The SITE Program was created to encourage the development and routine use of innovative treatment and monitoring and measurement technologies. Under the program, EPA enters into cooperative agreements with technology developers. These developers research and refine their innovative technologies at bench- or pilot-scale and then, with EPA's support, demonstrate them at hazardous waste sites. As a result, the SITE Program provides environmental decision-makers with data on new, viable treatment technologies that may have performance or cost advantages compared to traditional treatment technologies.

This document, prepared between August 1996 and December 1996, is intended as a reference guide for those interested in technologies participating in the SITE Demonstration, Emerging Technology, and Characterization and Monitoring Programs. The two–page profiles are organized into two sections for each program, completed and ongoing projects, and are presented in alphabetical order by developer name. Reference tables for SITE Program participants precede the sections and contain EPA and developer contacts. Inquiries about a SITE technology evaluation or the SITE Program should be directed to the specific EPA project manager; inquiries on the technology process should be directed to the specific technology developer.

Each technology profile contains (1) a technology developer and process name, (2) a technology description, including a schematic diagram or photograph of the process, (3) a discussion of waste applicability, (4) a project status report, and (5) EPA project manager and technology developer contacts. The profiles also include summaries of demonstration results, if available. The technology description and waste applicability sections are written by the developer. EPA prepares the status and demonstration results sections.

A Trade Name Index and Applicability Index and are also included in the back of this document. The Applicability Index is organized by 11 media categories, 19 waste categories, and 14 technology type categories.

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SITE PROGRAM DESCRIPTION

The U.S. Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) Program, now in its eleventh year, encourages the development and implementation of (1) innovative treatment technologies for hazardous waste site remediation, and (2) characterization and monitoring technologies for evaluating the nature and extent of hazardous waste site contamination.

The SITE Program was established by EPA's Office of Solid Waste and Emergency Response (OSWER) and the Office of Research and Development (ORD) in response to the 1986 Superfund Amendments and Reauthorization Act (SARA), which recognized a need for an "Alternative or Innovative Treatment Technology Research and Demonstration Program." The SITE Program is administered by ORD's National Risk Management Research Laboratory (NRMRL), headquartered in Cincinnati, Ohio.

The SITE Program includes the following component programs:

- **Demonstration Program** – Conducts and evaluates demonstrations of promising innovative technologies to provide reliable performance, cost, and applicability information for site cleanup decision–making

- **Emerging Technology Program** – Provides funding to developers to continue research efforts from the bench– and pilot–scale levels to promote the development of innovative technologies

- **Characterization and Monitoring Program** – Evaluates technologies that detect, monitor, and measure hazardous and toxic substances to provide better, faster, and more cost–effective methods for producing real–time data during site characterization and remediation

- **Technology Transfer Program** – Disseminates technical information, including engineering, performance, and cost data, on innovative technologies to remove impediments for using innovative technologies

This Technology Profiles document, a product of the Technology Transfer Program, describes completed and ongoing projects in the Demonstration, Emerging Technology, and Characterization and Monitoring Programs. Figure 1 shows the relationship among the programs and depicts the process of technology development from initial concept to commercial use.

In the Demonstration Program, the technology is field–tested on hazardous waste materials. Engineering and cost data are gathered on the innovative technology so that potential users can assess the technology's applicability to a particular site. Data collected during the field demonstration are used to assess the performance of the technology, the potential need for pre– and post–processing of the waste, applicable types of wastes and waste matrices, potential operating problems, and approximate capital and operating costs.

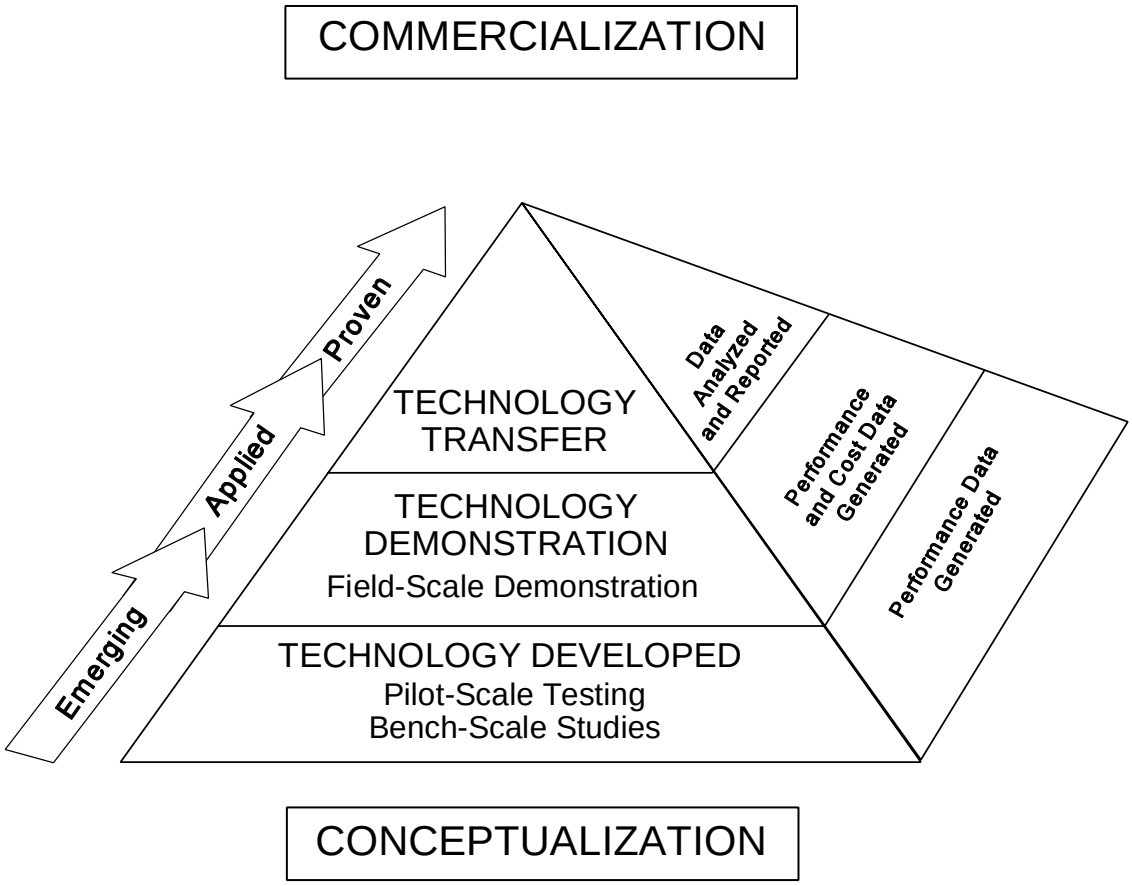

Figure 1: Development of Innovative Technologies

At the conclusion of a SITE demonstration, EPA prepares an Innovative Technology Evaluation Report (ITER), Technology Capsule, and Demonstration Bulletin. Often, a videotape of the demonstration is also prepared. These reports evaluate all available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Testing procedures, performance and cost data, and quality assurance and quality control standards are also presented. These demonstration documents are distributed by EPA to provide reliable technical data for environmental decision–making and to promote the technology's commercial use.

The Demonstration Program currently has 103 developers conducting 113 demonstrations. Of these projects, 85 demonstrations are complete and 28 are ongoing. The projects are divided into the following categories: thermal destruction (10), biological degradation (21), physical/chemical treatment (45), solidification/stabilization (10), physical/chemical radioactive waste treatment (2), physical/chemical thermal desorption (19), physical/chemical biological degradation (1), materials handling (3), and other (2). Several technologies represent more than one treatment category. Figure 2 shows the breakdown of technologies in the Demonstration Program.

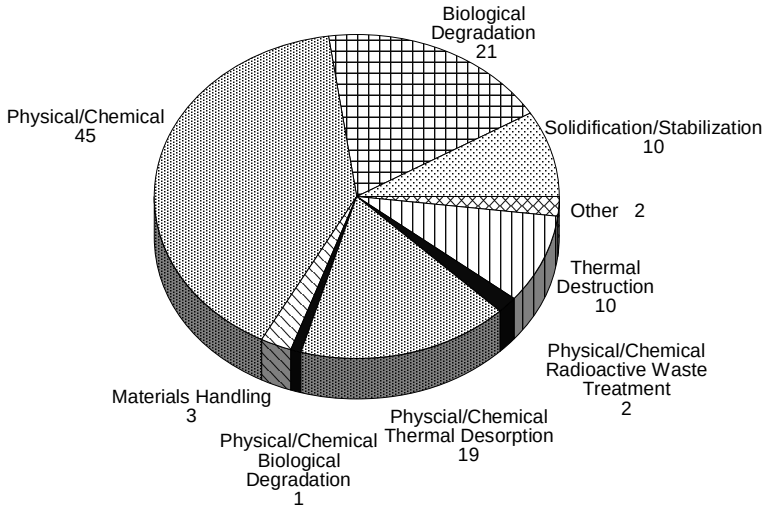

Figure 2: Innovative Technologies in the Demonstration Program

Under the Emerging Technology Program, EPA provides technical and financial support to developers for bench– and pilot–scale testing and evaluation of innovative technologies that are at a minimum proven on the conceptual and bench-scale levels. The program provides an opportunity for a private developer to research and develop a technology for field application and possible evaluation under the Demonstration Program. A technology's performance is documented in a Final Report, journal article, Summary, and Bulletin.

EPA has provided technical and financial support to 77 projects in the Emerging Technology Program. Of these projects, 55 are completed, 18 are ongoing in the program, and 4 have exited the program. Eighteen Emerging Technology Program projects are participating in the Demonstration Program. The 74 active technologies are divided into the following categories: thermal destruction (9), physical/chemical treatment (38), biological degradation (19), solidification/stabilization (2), and materials handling (5). Figure 3 displays the breakdown of technologies in the Emerging Technology Program.

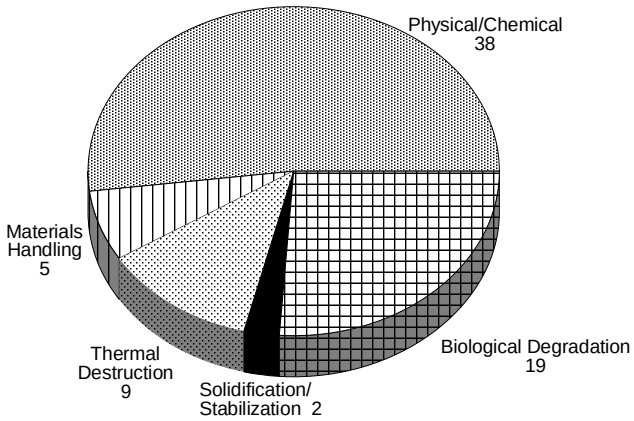

Figure 3: Innovative Technologies in the Emerging Technology Program

The Characterization and Monitoring Program's (CaMP) goal is to assess innovative and alternative monitoring, measurement, and site characterization technologies. To date, 116 technology demonstrations have been completed under the SITE Program (85 in the Demonstration Program and 39 in the CaMP); many reports have been published and others are in various stages of completion.

In the Technology Transfer Program, technical information on innovative technologies in the Demonstration Program, Emerging Technology Program, and CaMP is disseminated to increase the awareness and promote the use of innovative technologies for assessment and remediation at Superfund sites. The goal of technology transfer activities is to promote communication among individuals requiring up–to–date technical information.

The Technology Transfer Program reaches the environmental community through many media, including:

- Program-specific regional, state, and industry brochures
- On–site Visitors' Days during SITE demonstrations
- Demonstration videotapes
- Project–specific fact sheets to comply with site community relations plans
- ITERs, Demonstration Bulletins, Technology Capsules, and Project Summaries
- The SITE Exhibit, displayed nationwide and internationally at conferences
- Networking through forums, associations, regions, and states
- Technical assistance to regions, states, and remediation cleanup contractors

SITE information, including an electronic version of this document, is available through the following on–line information clearinghouses:

SITE Program Home Page: www.epa.gov/ORD/SITE/

Alternative Treatment Technology Information Center (ATTIC)
System operator: 513-569-7272; Bulletin Board Access: 513-569-7610;
Internet Access: cinbbs.cin.epa.gov

Vendor Information System for Innovative Treatment Technologies (VISITT)
Hotline: 800–245–4505; Internet Access: www.prcemi.com/visitt

Vendor Field Analytical and Characterization Technology (Vendor Facts)
Hotline: 800-245-4505; Internet Access: www.prcemi.com.vfacts

Cleanup Information Bulletin Board System (CLU-IN)
Help Desk: 301-589-8368; Modem: 301-589-8366; Internet Access: www.clu-in.com

Technical reports may be obtained by completing the document order form at the back of this document (page 433) or calling the Center for Environmental Research Information (CERI) in Cincinnati, Ohio. Additional SITE documents become available throughout the year. To find out about newly published documents or to be placed on the SITE mailing list, call 513-569-7562 or write to:

CERI
26 West Martin Luther King Drive (G72)
Cincinnati, OH 45268

SITE PROGRAM CONTACTS

The SITE Program is administered by EPA's Office of Research and Development (ORD), specifically the National Risk Management Research Laboratory (NRMRL). For further information on the SITE Program or its component programs contact:

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DEMONSTRATION PROGRAM

The SITE Demonstration Program develops reliable engineering, performance, and cost data on innovative, alternative technologies so that potential users can evaluate a technology's applicability for a specific waste site. Demonstrations are conducted at hazardous waste sites, such as National Priorities List (NPL) sites, non–NPL sites, and state sites, or under conditions that simulate actual hazardous waste sites.

In the past, technologies have been selected for the SITE Demonstration Program through annual requests for proposal (RFP). EPA reviewed proposals to determine the technologies with promise for use at hazardous waste sites. Several technologies also entered the program from current Superfund projects, in which innovative techniques of broad interest were identified for evaluation under the program. In addition, several Emerging Technology projects moved to the Demonstration Program. To date, 11 solicitations have been completed — SITE 001 in 1986 through SITE 010a in 1996.

In 1997, the program will shift from a technology-driven focus to a more integrated approach driven by the needs of the hazardous waste remediation community. The general solitication for technologies, the annual RFP, will no longer be issued. Instead, a team of stakeholders will match technologies with a selected site, which will be identified by the SITE Program. The stakeholders will evaluate proposals from many technology developers to determine the appropriate innovative technology for the site. Also, information about technologies will be continually collected and maintained in a database, which will serve as a resource to the stakeholders.

The SITE demonstration process typically consists of five steps: (1) matching an appropriate site with an innovative technology; (2) preparing a Demonstration Plan consisting of the test plan, sampling and analysis plan, quality assurance project plan, and health and safety plan; (3) performing community relations activities; (4) conducting the demonstration (ranging in length from days to months); and (5) documenting results in an Innovative Technology Evaluation Report, a Technology Capsule, a Demonstration Bulletin, or other demonstration documents. A demonstration videotape may also be prepared.

Cooperative arrangements among EPA, the developer, and the stakeholders set forth responsibilities for conducting the demonstration and evaluating the technology. Developers are responsible for operating their innovative systems at a selected site, and are expected to pay the costs to transport equipment to the site, operate the equipment on site during the demonstration, and remove the equipment from the site. EPA is responsible for project planning, sampling and analysis, quality assurance and quality control, preparing reports, and disseminating information.

Demonstration data are used to assess the technology's performance, the potential need for pre– and post–processing of the waste, applicable types of wastes and media, potential operating problems, and the approximate capital and operating costs. Demonstration data can also provide insight into long–term operating and maintenance costs and long–term risks.

The Demonstration Program currently includes 103 developers and 113 projects. These projects are organized into two sections: completed projects and ongoing projects. The completed projects are presented in alphabetical order by developer name in Table 1 and in the profiles that follow; the ongoing projects are presented in Table 2 and in the profiles that follow.